arylalkoxy, amino, aminoalkyl, alkylaminoalkyl, dialkylaminoalkyl, arylaminoalkyl, diarylaminoalkyl, alkylamino, dialkylamino, arylamino, diarylamino, alkylarylamino, alkylcarbonylamino, alkoxycarbonylamino, arylcarbonylamino, aryloxycarbonylamino, azido, alkylthio, arylthio, perfluoroalkylthio, thiocyano, isothiocyano, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, aminosulfonyl, alkylaminosulfonyl, dialkylaminosulfonyl, arylaminosulfonyl or diarylamino-sulfonyl;

(b) separating and purifying the product of step (a);

(c) reacting the product of step (b) with a second monomer $N^2$, a dimer $N^2$-$N^3$ or a trimer $N^2$-$N^3$-$N^4$; and

(d) repeating steps (b) and (c) to produce an LPC-bound biopolymer having m monomers, where m is 3 to 100, wherein:

$N^1$, $N^2$, $N^3$...$N^m$ are biopolymer monomers;

the dimers and trimers comprise the monomers; and

the protocol used in steps (c) and (d) to synthesize the biopolymer is the phosphoramidite protocol.

B9 concld

49. (Amended) The LPC of claim 6 coupled to a biopolymer.

**REMARKS**

This Preliminary Amendment is filed in connection with filing a Continued Prosecution Application (CPA) of Serial No. 09/484,484, filed January 18, 2000. A check for the filing fee for the CPA and a three-month extension of time accompanies this response. Any fees that may be due in connection with filing this paper, if the attached check is improper, in the wrong amount, or missing, or with this application or the parent application during their entire pendency, may be charged to Deposit Account No. 50-1213. If a Petition for Extension of Time is required, this paper is to be considered such petition.

Claims 6, 7, 9-11, 14-17, 20-22, 25, 26, 29, 31, 32, 39, 40, 45 and 47-49 are pending herein. Claims 1-5, 8, 12, 13, 18, 19, 23, 24, 27, 28, 30, 33-38, 41-44 and 46 are cancelled herein without prejudice or disclaimer.

Applicant reserves the right to file continuation and/or divisional applications directed to any cancelled subject matter.

Claims 6, 7, 9, 10, 17, 22, 29, 31, 32, 39, 40, 45 and 47-49 are amended herein. Claim 6 has been rewritten as an independent claim incorporating the limitations of the base claim. The remaining claims are amended to provide proper dependency. No amendment herein is intended to avoid any art of record or to address any of the instant rejections (except for the rejection under 35 U.S.C. §101 for alleged statutory double patenting). Basis for the definition of the variable Z as "any combination of 1-12 units selected from 1,4-phenylene and methylene units..." may be found, for example, in the specification at page 19, lines 24-28, page 21, lines 13-17, page 24, lines 24-27, and page 27, lines 17-21. Applicant does not agree with the propriety of the rejections herein. The claims have been amended herein solely to advance the prosecution of this application to allowance. Any cancelled subject matter will be prosecuted in the parent application (U.S. application Serial No. 09/067,337) or in continuation and/or divisional applications.

**PROVISIONAL REJECTION OF CLAIMS 1-9 AND 27-49 UNDER 35 U.S.C. §101**

Claims 1-9 and 27-49 are provisionally rejected under 35 U.S.C. §101 as allegedly claiming the same subject matter as that of claims 1-9 and 27-49 of co-pending U.S. application Serial No. 09/067,337. The test for statutory double patenting is whether one can infringe the claims of the patent and not infringe the claims of the application. If so, there is no statutory double patenting. In this instance, the test is met.

Applicant respectfully submits that the amendments to the instant claims herein render this rejection moot. For example, claim 6 has been amended herein to recite "Z is any combination of 1-12 units selected from *1,4-phenylene and methylene* units..." (emphasis added). Therefore, the instant claims are not

of the same scope as the claims in U.S. application Serial No. 09/067,337. Applicant respectfully requests reconsideration and withdrawal of this rejection.

**REJECTION OF CLAIMS 1-49 UNDER 35 U.S.C. §112, FIRST PARAGRAPH**

Claims 1-49 are rejected under 35 U.S.C. §112, first paragraph, for alleged lack of enablement. It is urged that incorporation by reference to a foreign application or foreign patent or to a publication of allegedly essential material is improper. Applicant respectfully traverses this rejection.

**Relevant Law**

In order to satisfy the enablement requirement of 35 U.S.C. §112, first paragraph, the specification must teach one of skill in the art to make and use the invention. Atlas Powder Co. v. E.I. DuPont de Nemours, 750 F.2d 1569, 224 USPQ 409. That some experimentation is needed, does not preclude enablement as long such experimentation is not undue. In re Marzocci et al., 469 USPQ 367 (CCPA 1971).

The amount of experimentation that is permissible depends upon a number of factors, which include: the quantity of experimentation necessary, the amount of direction or guidance presented, the presence or absence of working examples, the nature of the invention, the state of the prior art, the relative skill of those in the art, the predictability of the art, and the breadth of the claims. Ex parte Forman, 230 USPQ 546 (Bd. Pat. App. & Int'f 1986); see also In re Wands, 8 USPQ2d 1400 (Fed. Cir. 1988).

Patents are written to enable those skilled in the art to practice the invention. A patent need not disclose what is well known in the art. W.L. Gore & Assoc. v. Gorlock, Inc., 721 F.2d 1540, 1556, 220 USPQ 303, 315.

To limit the claims involving the specific materials disclosed in the examples so that a competitor seeking to avoid infringing the claims can merely follow the disclosure and substitute is contrary to the purpose for which the patent system exists - to promote progress in the useful arts. In re Goffe, 542 F.2d 801, 166 USPQ 85 (CCPA 1970).

An assertion by the PTO that the enabling disclosure is not commensurate in scope with the protection sought must be supported by evidence or reasoning substantiating the doubts expressed. In re Armbruster, 512 F2d 676, 185 USPQ 152 (CCPA 1975).

The requirements of 35 USC §112, first paragraph can be fulfilled by the use of illustrative examples or by broad terminology. In re Anderson, 176 USPQ 331, 333 (CCPA 1973):

> ...we do not regard section 112, first paragraph, as requiring a specific example of everything within the scope of a broad claim . . . What the Patent Office is here apparently attempting is to limit all claims to the specific examples, not withstanding the disclosure of a broader invention. This it may not do.

See also, In re Grimme, Keil and Schmitz, 124 USPQ 449, 502 (CCPA 1960) :

> It is manifestly impracticable for an applicant who discloses a generic invention to give an example of every species falling within it, or even to name every such species. It is sufficient if the disclosure teaches those skilled in the art what the invention is and how to practice it.

The law does not require an applicant to describe in the specification every conceivable embodiment of the invention. SRI Int'l v. Matsushita Elec. Corp of America, 775 F.2d 1107, 1121, 227 USPQ 577, 586 (Fed. Cir. 1985).

**Analysis**

**Incorporation by Reference**

It is alleged that incorporation by reference to non-patent publications is improper because the material described in the articles includes essential subject matter related to the description of linker molecules (page 37) and methods for the synthesis protocols for biopolymers (page 46, lines 23 and 24). Applicant respectfully submits that the articles referred to in the cited passages do not include essential subject matter because the incorporated references merely provide examples of linkers and methods of biopolymer synthesis that are well known to those of skill in the art.

**Linkers**

The specification at page 36, line 1, discloses LPCs coupled to linkers. The linkers that may be coupled to the LPCs provided in the specification are any known to those of skill in the art. Such linkers are well known and are available from numerous commercial sources. As disclosed in the specification, the linkers have traditionally been used in solid phase synthesis of biopolymers, and include, for example, photocleavable, traceless, safety-catch or other linkers (see, e.g., page 36, lines 4-7). The references listed on page 36, line 7 through page 37, line 3 include publications and U.S. patents that describe linkers and are included merely to provide examples of what is well known to those of skill in the art.

**Methods for the Synthesis of Biopolymers**

The specification, at page 45, line 25, discloses that synthesis of the biopolymeric chain in the methods provided in the application may be carried out using any protocols known to those of skill in the art. Such protocols are well known. In the synthesis of oligonucleotides, protocols including the phosphate triester, H-phosphonate, or phosphoramidite protocols may be used (see, e.g., page 45, lines 27-29). These protocols are well known to those of skill in the art. The publications and U.S. patents listed at page 45, line 29 through page 46, line 7 are included merely to provide examples of what is well known to those of skill in the art.

Similarly, references are provided for synthetic protocols for preparation of peptides, peptide nucleic acids and oligosaccharides merely to give examples of what is well known to those of skill in the art (see, e.g., page 46, lines 10-22).

**The Cited References do not contain Essential Subject Matter**

None of these cited references contains subject matter essential to the instant claims. The references merely provide examples of what is well known to those of skill in the art. Other linkers or biopolymer synthetic protocols can be used in the compositions and methods encompassed by the instant claims. Patents are written to enable those skilled in the art to practice the invention. A patent need not disclose what is well known in the art. W.L. Gore & Assoc. v. Gorlock, Inc., 721 F.2d 1540, 1556, 220 USPQ 303, 315.

Therefore, since the references provided in the specification on page 36 line 7 through page 37, line 3, and on page 45, line 29 through page 46, line 22 are not essential material, but merely exemplify what is well known to those of skill in the art, it is not necessary to amend the disclosure to include the material incorporated by reference. Applicant respectfully requests reconsideration and removal of this rejection.

**Scope of $X^1$**

The Office Action also alleges that there is not seen in the disclosure support commensurate in scope with the description of the variable $X^1$ to be represented by "any reactive group which can be used in biopolymer synthesis." It is urged that there is support for $X^1$ to be represented by OH, SH, $NH_2$, $COR^5$ and $COOR^4$, but not any reactive group.

While not agreeing with the propriety of this rejection, Applicant has amended the recitation for $X^1$ in the instant claims to be "OH, SH, $NH_2$, $COR^5$ and $COOR^4$..." Basis for this amendment may be found, for example, in claim 6 as originally filed. Applicant respectfully submits that this amendment has rendered this ground of rejection moot.

**REJECTION OF CLAIMS 1-49 UNDER 35 U.S.C. §112, SECOND PARAGRAPH**

Claims 1-49 are rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully requests reconsideration of this rejection in view of the amendments to the claims herein and the following remarks.

**Claims 1, 33 and 45**

Claims 1, 33 and 45 are rejected as allegedly being indefinite for failing to provide a chemical name or structural formula for Sp, n and $X^1$. Applicant respectfully disagrees.

It is first noted that although Applicant does not agree with the propriety of this rejection, in the interest of advancing the prosecution of this application to allowance claims 1 and 33 have been cancelled herein without prejudice or disclaimer. Applicant further notes that the variables Sp and n do not appear in claim 45. Applicant requests that the following comments be made of record in this application.

**Sp**

The variable Sp was defined in claims 1 and 33 by functional language, thereby uniquely identifying the groups encompassed by the claim. Sp was defined in claims 1 and 33 as "a polyvalent group that has more than two points of attachment." Thus, Sp is not a monovalent group, nor is it a divalent group. Sp is further defined in the specification as including, without limitation, "an atomic group, a cyclic group or an aromatic group (heterocycles, carbocycles, aryls, heteroaryls, such that the resulting structure is symmetrically disposed around the center of the cyclic group), that has more than two points of attachment" (see, e.g., page 3, lines 1-4). Sp also represents, in certain embodiments, $(R^1)_p$-A, E or a cyclic group (i.e., heterocycles, carbocycles, aryls, heteroaryls, such that the resulting structure is symmetrically disposed around the center of the cyclic group)(see, e.g., page 3, lines 31-33). Thus, the

specification provides functional definitions of Sp and numerous examples (supra). Based on this disclosure, one of ordinary skill in the art would be able to determine whether a given moiety was within the scope of Sp. Therefore, it is respectfully submitted that the variable Sp is not indefinite to a person having ordinary skill in the art.

**n**

The variable n in claims 1 and 33 related to the number of points of attachment in Sp. Since, as described in detail above, the variable Sp is not indefinite, the variable n is likewise not indefinite.

**$X^1$**

**Claims 1 and 33**

The variable $X^1$ was defined in claims 1 and 33 by functional language, thereby uniquely identifying the groups encompassed by the claim. $X^1$ was defined in claims 1 and 33 as a reactive group that may be used in biopolymer synthesis. Thus, $X^1$ does not encompass any reactive group, but only those groups that are useful in biopolymer synthesis. One of ordinary skill in the art would know what reactive groups would have such utility.

Furthermore, the specification provides non-limiting examples of such reactive groups, including, but not limited to, halide, preferably chloride, OH, SH, $NH_2$, $COR^5$ and $COOR^4$, where $R^4$ is hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl or heterocyclylalkyl, and $R^5$ is halide, heteroaryl, aryl or pseudohalide. (see, e.g., page 26, lines 19-21, page 31, lines 10-15).

The specification provides examples of the $X^1$ groups that are preferably used for synthesis of various biopolymers, thereby further defining the scope of $X^1$. LPCs for use in oligonucleotide synthesis may contain, for example, a carboxylic acid group at the terminus of $X^1$ (see, e.g., page 32, lines 30-31. LPCs for use in peptide synthesis or peptide nucleic acid synthesis may contain, for example, a haloalkyl, hydroxyl, thio or carboxyl group at the terminus of $X^1$

(see, e.g., page 34, lines 13-14 and page 35, lines 15-16). LPCs for use in oligosaccharide synthesis may contain, for example, a hydroxyl, thio or carboxyl group at the terminus of $X^1$ (see, e.g., page 35, lines 24-25).

Therefore, the variable $X^1$, when viewed in light of the specification and the knowledge of one of ordinary skill in the art, is not indefinite.

**Claim 45**

The above comments regarding the recitation for $X^1$ in claims 1 and 33 also applies for claim 45 as originally filed. Applicant, while not agreeing with the propriety of this rejection, has amended the recitation for $X^1$ in claim 45 herein to read "$X^1$ is OH, SH, $NH_2$, $COR^5$ or $COOR^4$, where $R^4$ is selected from hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl and heterocyclylalkyl; and $R^5$ is halide, heteroaryl or pseudohalide." Applicant respectfully submits that this ground of rejection has therefore been rendered moot.

**Claims 5 and 38**

Claims 5 and 38 are rejected as allegedly being indefinite for defining the variable $X^1$ twice. While not necessarily agreeing with the propriety of this rejection, Applicant has cancelled claims 5 and 38 herein, thereby rendering this rejection moot. Applicant reserves the right to file continuation and/or divisional applications directed to any cancelled subject matter. Applicant further requests that the following remarks be made of record in this application.

Applicant respectfully submits that $X^1$ is only defined once in each claim. Claim 5 defined $X^1$ as "any reactive group which can be used in biopolymer synthesis." Claim 38 defined $X^1$ as "any reactive group which can be used in biopolymer synthesis." This variable is not further defined in either of these claims.

The Office Action states that $X^1$ is defined as "any reactive group, and the claim also recites a Markush grouping definition..." Applicant respectfully submits that claims 5 and 38 did not contain a Markush grouping definition for

$X^1$. These claims did recite a Markush group for the variables A, E, $R^1$, $R^3$, p, n, $Y^1$ and $Y^2$. The claims further recited that the variables $R^1$, $R^3$, $X^1$, $Y^1$, $Y^2$ and Z are unsubstituted or substituted with one or more substituents each independently selected from Q, where Q is defined by a Markush group. Thus, the claims defined a Markush group for the substituents that may be present on $X^1$, but did not recite a Markush group for $X^1$ itself. Applicant respectfully requests reconsideration and withdrawal of this rejection.

**Claim 8**

Claim 8 is rejected as allegedly being indefinite for not separating the structural formulae with commas. While not necessarily agreeing with the propriety of this rejection, Applicant has cancelled claim 8 herein in the interest of advancing the prosecution of this case to allowance. It is respectfully submitted that this ground of rejection has therefore been rendered moot.

**Claim 33**

Claim 33 is rejected as allegedly being indefinite because the variable $N^m$ is allegedly not defined. Applicant respectfully disagrees. It is first noted that claim 33 has been cancelled herein. Claim 39 has been rewritten as an independent claim incorporating the limitations of claim 33. Applicant requests that the following remarks be considered herein.

Claim 39 recites "$N^1$, $N^2$, $N^3$...$N^m$ are biopolymer monomers." Thus, $N^m$ is a biopolymer monomer. Furthermore, m is defined as "3 to 100," thereby defining the length of the biopolymer chain.

It is further alleged that claim 33 is confusing where in the last line of the claims "dimers and trimers are monomers." Applicant respectfully disagrees. The last line of instant claim 33 (and now claim 39) recites "the dimers and trimers comprise the monomers" (emphasis added). Therefore, the "dimers" and "trimers" of claim 33 (and now claim 39) are not monomers, but rather are comprised of the monomers. A dimer comprises two monomers and a trimer comprises three monomers.

Applicant respectfully submits that claim 33 (and claim 39) is not indefinite for the reasons stated above. Reconsideration and withdrawal of this rejection is respectfully requested.

* * *

In view of the above, reconsideration and allowance of the application are respectfully requested.

Respectfully submitted,
HELLER EHRMAN WHITE & McAULIFFE LLP

By: _____
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Attorney Docket No. 24743-2301B

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Koster et al.

Serial No.: 09/484,484

Confirmation No.: 9747

Filed: January 18, 2000

For: *SOLUTION PHASE BIOPOLYMER SYNTHESIS*

Art Unit: 1623

Examiner: Wilson, J.

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" Mailing Label Number EL675147641US

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Rita Jennings

## ATTACHMENT TO PRELIMINARY AMENDMENT

The following attachment is provided:

(1) a marked up copy of claims 6, 7, 9, 10, 17, 22, 29, 31, 32, 39, 40, 45 and 47-49 showing the amendments herein.

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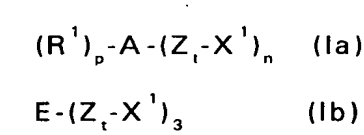
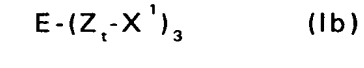
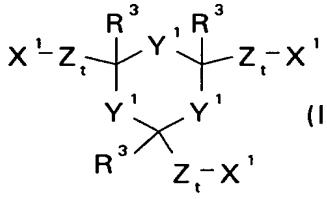
Rita Jennings

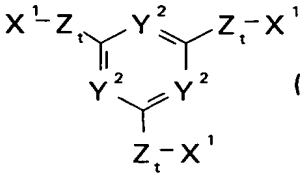
## MARKED UP CLAIMS (37 CFR §1.121)

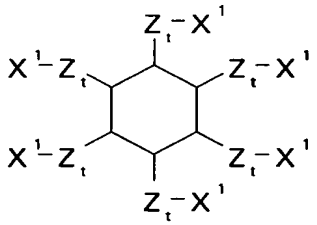
6. (Amended) [The LPC of claim 5,] A liquid phase carrier (LPC) that has formulae (I):

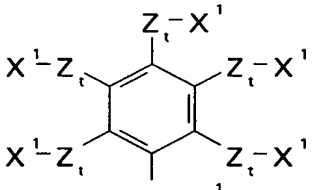

(Ia)


(Ib)


(Ic)


(Id)


(Ie)


(If)

wherein: A is carbon or silicon; E is nitrogen or P(O); $R^1$ and $R^3$ are each independently hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl or heterocyclylalkyl; p is 0 or 1; Z is any combination of 1-12 units selected from 1,4-phenylene and methylene units, which units may be combined in any order, with the proviso that if the LPC is of formula (Ia) or (Ib),

then Z contains at least two phenylene or methylene units; t is 1; $X^1$ is OH, SH, $NH_2$, $COR^5$ or $COOR^4$ where $R^4$ is selected from hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl and heterocyclylalkyl, and $R^5$ is halide, heteroaryl or pseudohalide; n is 3 or 4; $Y^1$ is $CH_2$, NH, S or O; $Y^2$ is selected from CH and N; $R^1$, $R^3$, $X^1$, $Y^1$, $Y^2$ and Z are unsubstituted or substituted with one or more substituents each independently selected from Q; and Q is halogen, hydroxy, nitrile, nitro, formyl, mercapto, carboxy, alkyl, haloalkyl, polyhaloalkyl, aminoalkyl, diaminoalkyl, alkenyl containing 1 to 2 double bonds, alkynyl containing 1 to 2 triple bonds, cycloalkyl, cycloalkylalkyl, aryl, heteroaryl, arylalkyl, heteroarylalkyl, alkylidene, arylalkylidene, alkylcarbonyl, arylcarbonyl, heteroarylcarbonyl, alkoxycarbonyl, alkoxycarbonylalkyl, aryloxycarbonyl, aryloxycarbonylalkyl, aminocarbonyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylaminocarbonyl, diarylaminocarbonyl, arylalkylaminocarbonyl, alkoxy, aryloxy, perfluoroalkoxy, alkenyloxy, alkynyloxy, arylalkoxy, amino, aminoalkyl, alkylaminoalkyl, dialkylaminoalkyl, arylaminoalkyl, diarylaminoalkyl, alkylamino, dialkylamino, arylamino, diarylamino, alkylarylamino, alkylcarbonylamino, alkoxycarbonylamino, arylcarbonylamino, aryloxycarbonylamino, azido, alkylthio, arylthio, perfluoroalkylthio, thiocyano, isothiocyano, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, aminosulfonyl, alkylaminosulfonyl, dialkylaminosulfonyl, arylaminosulfonyl or diarylaminosulfonyl.

7. (Amended) The LPC of claim [5] 6, wherein Z is a group with three or more points of attachment: one to A, E, or the cyclic nucleus, and the others to two or more $X^1$ groups.

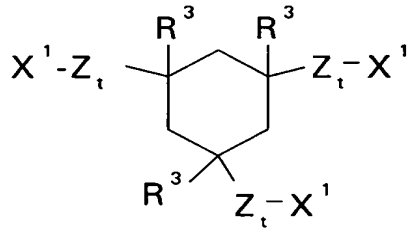
9. (Amended) The LPC of claim [5] 6, wherein: A is carbon and E is nitrogen.

10. (Amended) The LPC of claim [5] 6, wherein the LPC has formulae (IIa) or (IIb):

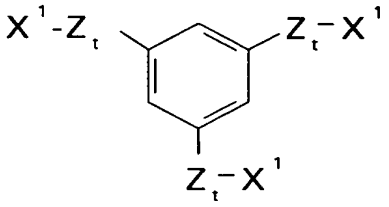
$(R^1)_p\text{-}C\text{-}(Z_t\text{-}X^1)_n$ (IIa)

$N\text{-}(Z_t\text{-}X^1)_3$ (IIb)

17. (Amended) The LPC of claim [5] 6, wherein the LPC has formulae (IIc) or (IId):

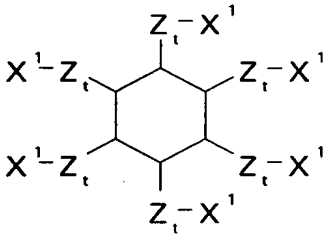


(IIc)

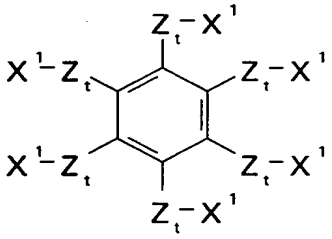


(IId)

22. (Amended) The LPC of claim [5] 6, wherein the LPC has formulae (Ie) or (If):



(Ie)



(If)

29. (Amended) The LPC of claim [1] 6 that is coupled to a photocleavable linker.

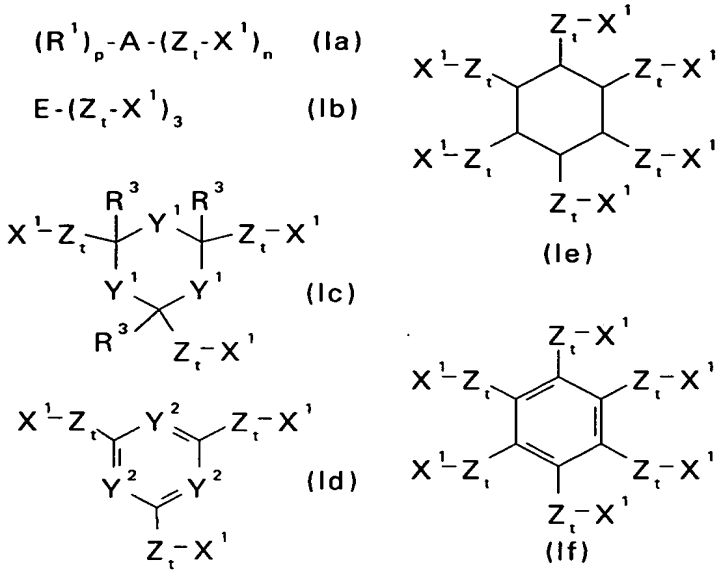
31. (Amended) [The LPC of claim 1] A liquid phase carrier (LPC), selected from the group consisting of **[tetrakis(8-amino-6-aza-2-oxa-5-oxooctyl)methane, tetrakis(11-carboxy-6,9-diaza-5,10-dioxo-2-**

**oxaundecyl)methane, tris(3-aza-6-carboxy-4-oxohexyl)amine, 1,3,5-benzenetricarboxylic acid tris-N-(2-aminoethyl)amide, 1,3,5-benzenetricarboxylic acid tris-N-(3-aza-6-carboxy-4-oxohexyl)amide,]** tetrakis{6,9-diaza-13-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-2-oxa-5,10,13-trioxotridecyl}methane ((DMT-dT)$_4$-PE-LPC), 1,3,5-tris{2,5-diaza-9-[5'-O-(4,4'-dimethoxytriphenyl-methyl)-2'-deoxythymidine-3'-O-yl]-1,6,9-trioxononyl}-benzene ((DMT-dT)$_3$-Aryl-LPC), tetrakis[13-(2'-deoxythymidin-3'-O-yl)-6,9-diaza-2-oxa-5,10,13-trioxotridecyl]-methane (dT$_4$-PE-LPC), 1,3,5-tris[9-(2'-deoxythymidin-3'-O-yl)-2,5-diaza-1,6,9-trioxononyl]-benzene (dT$_3$-Aryl-LPC), tris-{3-aza-4,7-dioxo-7-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-heptyl}-amine ((DMT-dT)$_3$-Amine-LPC) and tris[3-aza-7-(2'-deoxythymidine-3'-O-yl)-4,7-dioxoheptyl]-amine (dT$_3$-Amine-LPC).

32. (Amended) The LPC of claim [1] 31 selected from the group consisting of **[tetrakis(11-carboxy-6,9-diaza-5,10-dioxo-2-oxaundecyl)methane, tris(3-aza-6-carboxy-4-oxohexyl)amine, 1,3,5-benzenetricarboxylic acid tris-N-(3-aza-6-carboxy-4-oxohexyl)amide,]** tetrakis{6,9-diaza-13-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-2-oxa-5,10,13-trioxotridecyl}methane ((DMT-dT)$_4$-PE-LPC), 1,3,5-tris{2,5-diaza-9-[5'-O-(4,4'-dimethoxytriphenyl-methyl)-2'-deoxythymidine-3'-O-yl]-1,6,9-trioxononyl}-benzene ((DMT-dT)$_3$-Aryl-LPC), tetrakis[13-(2'-deoxythymidin-3'-O-yl)-6,9-diaza-2-oxa-5,10,13-trioxotridecyl]-methane (dT$_4$-PE-LPC), 1,3,5-tris[9-(2'-deoxythymidin-3'-O-yl)-2,5-diaza-1,6,9-trioxononyl]-benzene (dT$_3$-Aryl-LPC), tris-{3-aza-4,7-dioxo-7-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-heptyl}-amine ((DMT-dT)$_3$-Amine-LPC) and tris[3-aza-7-(2'-deoxythymidine-3'-O-yl)-4,7-dioxoheptyl]-amine (dT$_3$-Amine-LPC).

39. (Amended) [The method of claim 38,] A method of solution phase biopolymer synthesis, comprising the steps of:

(a) reacting an LPC with a first monomer $N^1$; wherein the LPC has formulae (I):



wherein: A is carbon or silicon; E is nitrogen or P(O); $R^1$ and $R^3$ are each independently hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl or heterocyclylalkyl; p is 0 or 1; Z is any combination of 0-12 units selected from 1,4-phenylene and methylene, which units may be combined in any order; t is 0 or 1; $X^1$ is OH, SH, $NH_2$, $COR^5$ or $COOR^4$, where $R^4$ is selected from hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl and heterocyclylalkyl; and $R^5$ is halide, heteroaryl or pseudohalide; n is 3 or 4; $Y^1$ is $CH_2$, NH, S or O; $Y^2$ is selected from CH and N; $R^1$, $R^3$, $X^1$, $Y^1$, $Y^2$ and Z are unsubstituted or substituted with one or more substituents each independently selected from Q; and Q is halogen, hydroxy, nitrile, nitro, formyl, mercapto, carboxy, alkyl, haloalkyl, polyhaloalkyl, aminoalkyl, diaminoalkyl, alkenyl containing 1 to 2 double bonds, alkynyl containing 1 to 2 triple bonds, cycloalkyl, cycloalkylalkyl, aryl, heteroaryl, arylalkyl, heteroarylalkyl, alkylidene, arylalkylidene, alkylcarbonyl, arylcarbonyl, heteroarylcarbonyl, alkoxycarbonyl, alkoxycarbonylalkyl, aryloxycarbonyl, aryloxycarbonylalkyl, aminocarbonyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylaminocarbonyl, diarylaminocarbonyl, arylalkylaminocarbonyl, alkoxy, aryloxy, perfluoroalkoxy, alkenyloxy, alkynyloxy,

arylalkoxy, amino, aminoalkyl, alkylaminoalkyl, dialkylaminoalkyl, arylaminoalkyl, diarylaminoalkyl, alkylamino, dialkylamino, arylamino, diarylamino, alkylarylamino, alkylcarbonylamino, alkoxycarbonylamino, arylcarbonylamino, aryloxycarbonylamino, azido, alkylthio, arylthio, perfluoroalkylthio, thiocyano, isothiocyano, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, aminosulfonyl, alkylaminosulfonyl, dialkylaminosulfonyl, arylaminosulfonyl or diarylamino-sulfonyl;

(b) separating and purifying the product of step (a);

(c) reacting the product of step (b) with a second monomer $N^2$, a dimer $N^2$-$N^3$ or a trimer $N^2$-$N^3$-$N^4$; and

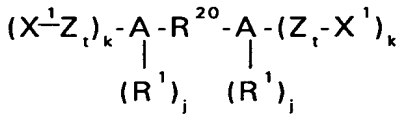
(d) repeating steps (b) and (c) to produce an LPC-bound biopolymer having m monomers, where m is 3 to 100, wherein:

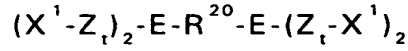
$N^1$, $N^2$, $N^3$...$N^m$ are biopolymer monomers; and

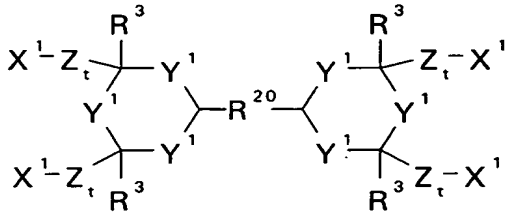
the dimers and trimers comprise the monomers.

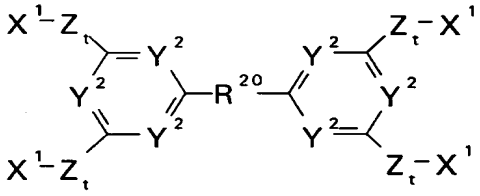
40. (Amended) The method of claim [33] 39, wherein the LPC is selected from the group consisting of **[tetrakis(11-carboxy-6,9-diaza-5,10-dioxo-2-oxaundecyl)methane, tris(3-aza-6-carboxy-4-oxohexyl)amine, 1,3,5-benzenetricarboxylic acid tris-N-(3-aza-6-carboxy-4-oxohexyl)amide,]** tetrakis{6,9-diaza-13-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-2-oxa-5,10,13-trioxotridecyl}methane ((DMT-dT)$_4$-PE-LPC), 1,3,5-tris{2,5-diaza-9-[5'-O-(4,4'-dimethoxytriphenyl-methyl)-2'-deoxythymidine-3'-O-yl]-1,6,9-trioxononyl}-benzene ((DMT-dT)$_3$-Aryl-LPC), tetrakis[13-(2'-deoxythymidin-3'-O-yl)-6,9-diaza-2-oxa-5,10,13-trioxotridecyl]-methane (dT$_4$-PE-LPC), 1,3,5-tris[9-(2'-deoxythymidin-3'-O-yl)-2,5-diaza-1,6,9-trioxononyl]-benzene (dT$_3$-Aryl-LPC), tris-{3-aza-4,7-dioxo-7-[5'-O-(4,4'-dimethoxytriphenylmethyl)-2'-deoxythymidine-3'-O-yl]-heptyl}-amine ((DMT-dT)$_3$-Amine-LPC) and tris[3-aza-7-(2'-deoxythymidine-3'-O-yl)-4,7-dioxoheptyl]-amine (dT$_3$-Amine-LPC).

45. (Amended) [The LPC of claim 1] A liquid phase carrier (LPC) that has formulae:









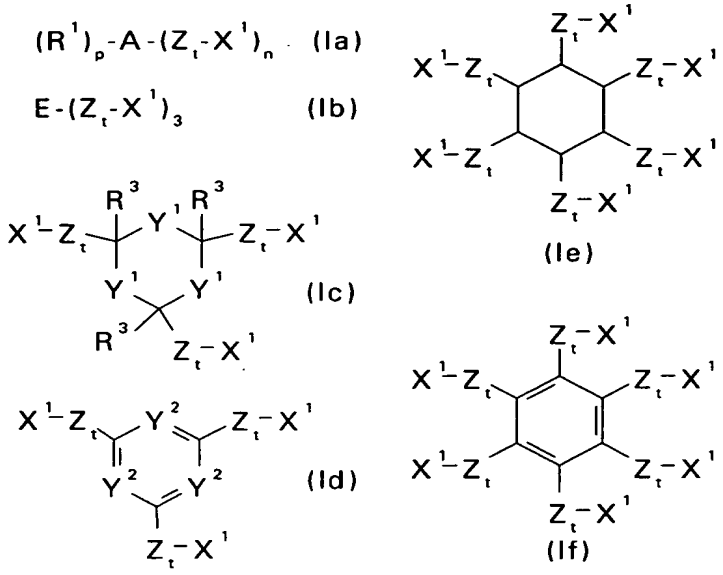
wherein: A is carbon or silicon; E is nitrogen or P(O); $R^1$ and $R^3$ are each independently hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl or heterocyclylalkyl; Z is any combination of 1-12 units selected from [1,2-, 1,3- or] 1,4-phenylene and [alkylene] methylene, which units may be combined in any order, with the proviso that if the LPC is of formula (Ia) or (Ib), then Z contains at least two phenylene or methylene units; t is 0 or 1; $X^1$ is [any reactive group which can be used in biopolymer synthesis] OH, SH, $NH_2$, $COR^5$ or $COOR^4$, where $R^4$ is selected from hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl and heterocyclylalkyl; and $R^5$ is halide, heteroaryl or pseudohalide; $Y^1$ is $CH_2$, NH, S or O; $Y^2$ is selected from CH and N; $R^1$, $R^3$, $X^1$, $Y^1$, $Y^2$ and Z are unsubstituted or substituted with one or more substituents each independently selected from Q; and Q is halogen, hydroxy, nitrile, nitro, formyl, mercapto, carboxy, alkyl, haloalkyl, polyhaloalkyl,

aminoalkyl, diaminoalkyl, alkenyl containing 1 to 2 double bonds, alkynyl containing 1 to 2 triple bonds, cycloalkyl, cycloalkylalkyl, aryl, heteroaryl, arylalkyl, heteroarylalkyl, alkylidene, arylalkylidene, alkylcarbonyl, arylcarbonyl, heteroarylcarbonyl, alkoxycarbonyl, alkoxycarbonylalkyl, aryloxycarbonyl, aryloxycarbonylalkyl, aminocarbonyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylaminocarbonyl, diarylaminocarbonyl, arylalkylaminocarbonyl, alkoxy, aryloxy, perfluoroalkoxy, alkenyloxy, alkynyloxy, arylalkoxy, amino, aminoalkyl, alkylaminoalkyl, dialkylaminoalkyl, arylaminoalkyl, diarylaminoalkyl, alkylamino, dialkylamino, arylamino, diarylamino, alkylarylamino, alkylcarbonylamino, alkoxycarbonylamino, arylcarbonylamino, aryloxycarbonylamino, azido, alkylthio, arylthio, perfluoroalkylthio, thiocyano, isothiocyano, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, aminosulfonyl, alkylaminosulfonyl, dialkylaminosulfonyl, arylaminosulfonyl or diarylaminosulfonyl; $R^{20}$ is alkylene, alkenylene, alkynylene, arylene or heteroarylene; k is 2 or 3; and j is 0 or 1.

47. (Amended) The method of claim [33] 39, wherein the monomers are nucleotides, nucleosides, natural or unnatural amino acids, protein nucleic acid (PNA) monomers or monosaccharides.

48. (Amended) A method of solution phase biopolymer synthesis, comprising the steps of:

(a) reacting an LPC [of formula $Sp(X^1)_n$] with a first monomer $N^1$; wherein the LPC has formulae (I):



wherein: A is carbon or silicon; E is nitrogen or P(O); $R^1$ and $R^3$ are each independently hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl or heterocyclylalkyl; p is 0 or 1; Z is any combination of 0-12 units selected from 1,2-, 1,3- or 1,4-phenylene and alkylene, which units may be combined in any order; t is 0 or 1; $X^1$ is OH, SH, $NH_2$, $COR^5$ or $COOR^4$, where $R^4$ is selected from hydrogen, alkyl, aryl, aralkyl, heteroaryl, heteroaralkyl, heterocyclyl and heterocyclylalkyl; and $R^5$ is halide, heteroaryl or pseudohalide; n is 3 or 4; $Y^1$ is $CH_2$, NH, S or O; $Y^2$ is selected from CH and N; $R^1$, $R^3$, $X^1$, $Y^1$, $Y^2$ and Z are unsubstituted or substituted with one or more substituents each independently selected from Q; and Q is halogen, hydroxy, nitrile, nitro, formyl, mercapto, carboxy, alkyl, haloalkyl, polyhaloalkyl, aminoalkyl, diaminoalkyl, alkenyl containing 1 to 2 double bonds, alkynyl containing 1 to 2 triple bonds, cycloalkyl, cycloalkylalkyl, aryl, heteroaryl, arylalkyl, heteroarylalkyl, alkylidene, arylalkylidene, alkylcarbonyl, arylcarbonyl, heteroarylcarbonyl, alkoxycarbonyl, alkoxycarbonylalkyl, aryloxycarbonyl, aryloxycarbonylalkyl, aminocarbonyl, alkylaminocarbonyl, dialkylaminocarbonyl, arylaminocarbonyl, diarylaminocarbonyl, arylalkylaminocarbonyl, alkoxy, aryloxy, perfluoroalkoxy, alkenyloxy, alkynyloxy,

arylalkoxy, amino, aminoalkyl, alkylaminoalkyl, dialkylaminoalkyl, arylaminoalkyl, diarylaminoalkyl, alkylamino, dialkylamino, arylamino, diarylamino, alkylarylamino, alkylcarbonylamino, alkoxycarbonylamino, arylcarbonylamino, aryloxycarbonylamino, azido, alkylthio, arylthio, perfluoroalkylthio, thiocyano, isothiocyano, alkylsulfinyl, alkylsulfonyl, arylsulfinyl, arylsulfonyl, aminosulfonyl, alkylaminosulfonyl, dialkylaminosulfonyl, arylaminosulfonyl or diarylamino-sulfonyl;

(b) separating and purifying the product of step (a) [to afford a compound of formula $Sp(X^1\text{-}N^1)_n$];

(c) reacting the product of step (b) with a second monomer $N^2$, a dimer $N^2\text{-}N^3$ or a trimer $N^2\text{-}N^3\text{-}N^4$; and

(d) repeating steps (b) and (c) to produce an LPC-bound biopolymer [of formula $Sp(X^1\text{-}N^1\text{-}N^2\text{-}\ldots\text{-}N^m)_n$] having m monomers, where m is 3 to 100, wherein:

[Sp is a polyvalent group that has two or more points of attachment, n corresponds to the number of points of attachment in Sp and $X^1$ is a reactive group for biopolymer synthesis;]

$N^1$, $N^2$, $N^3 \ldots N^m$ are biopolymer monomers;

the dimers and trimers comprise the monomers; and

the protocol used in steps (c) and (d) to synthesize the biopolymer[, preferably the oligonucleotide,] is the phosphoramidite protocol.

49. (Amended) The LPC of claim [1] 6 coupled to a biopolymer.